

NATIONAL RESEARCH COUNCIL  
COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND APPLICATIONS

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BOARD ON  
PHYSICS AND ASTRONOMY

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October 16, 1991

Ms. Donna R. Searcy  
Secretary  
Federal Communications Commission  
1919 M Street, N.W.  
Washington, D.C. 20554

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OCT 16 1991

Federal Communications Commission  
Office of the Secretary


In re Petitions for Rulemaking of	)	
Ellipsat Corporation	)	RM-7805
American Mobile Satellite Corporation	)	RM-7806
Constellation Communications	)	RM-7771
TRW, Inc.	)	RM-7773
Proposing a New Allocation of	)	
Spectrum for Mobile-Satellite Service	)	

Dear Ms. Searcy:

Transmitted herewith by the National Academy of Sciences—National Research Council's Committee on Radio Frequencies are an original and nine (9) copies of its Comments in the above-referenced proceedings.

If additional information is required concerning this matter, please communicate with this office.

Very truly yours,

  
Robert L. Riemer  
Senior Program Officer

Enclosure

BEFORE THE  
**Federal Communications Commission**  
WASHINGTON, D.C. 20554

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Federal Communications Commission  
Office of the Secretary

COMMENTS OF THE  
NATIONAL ACADEMY OF SCIENCES'  
COMMITTEE ON RADIO FREQUENCIES

NATIONAL ACADEMY OF SCIENCES  
Dr. Frank Press, President

October 16, 1991

## Summary

The Committee on Radio Frequencies ("CORF") of the National Academy of Sciences-National Research Council represents the interests of radio scientists, including radio astronomers, and researchers involved in remote sensing, wildlife telemetry, and meteorological research. In these Comments, CORF discusses the impact on radio science of proposals for a new allocation of spectrum for Mobile-Satellite Service by Ellipsat Corporation, American Mobile Satellite Corporation, Constellation Communications, Inc., and TRW, Inc.

CORF maintains that MSS uplinks should be allowed in the 1610.6-1613.8 MHz band only if the Radio Astronomy Service's allocation in that band is upgraded to Primary status and the Radio Astronomy Service can be afforded the required level of protection. This band is essential to the study of the hydroxyl line, which occurs in many types of objects in the galaxy.

CORF further maintains that proposals to allocate the 2483.5-2500 MHz band for MSS downlinks creates a potential problem for radio astronomy operations at 4990-5000 MHz and opposes any relaxation of the power flux density limits applicable to this band.

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Mobile-Satellite Service	)	

**COMMENTS OF THE COMMITTEE  
ON RADIO FREQUENCIES OF THE  
NATIONAL ACADEMY OF SCIENCES**

The Committee on Radio Frequencies of the National Academy of Sciences ("CORF") hereby offers its comments on the above-captioned petitions for rulemaking of Ellipsat Corporation ("Ellipsat"), American Mobile Satellite Corporation ("AMSC"), Constellation Communications ("Constellation"), and TRW, Inc. ("TRW").<sup>1/</sup>

Each of these petitioners, with the exception of AMSC, proposes to allocate the 1610-1626.5 MHz band for mobile-satellite service ("MSS") uplinks and the 2483.5-2500 MHz band for MSS downlinks. AMSC proposes to allocate the 1616.5-1626.5 MHz band for MSS uplinks and the 1515-1525 MHz band for MSS downlinks.

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<sup>1/</sup> These comments are timely filed pursuant to Public Notice dated September 13, 1991 (Mimeo No. 14747).

I. MSS Uplinks Should Be Allowed in the 1610.6-1613.8 MHz Band Only If the Radio Astronomy Service's Allocation in That Band Is Upgraded to Primary Status and the Radio Astronomy Service Can Be Afforded the Required Level of Protection

Ellipsat, Constellation, and TRW seek MSS uplink allocations in the current radiodetermination satellite service ("RDSS") uplink band, 1610-1626.5 MHz. In support of this request, they note, inter alia, that such an allocation would be consistent with the Commission's recommendation for that band in its WARC-92 Report.<sup>2/</sup> See TRW Petition at 4-5; Ellipsat Petition at 6; Constellation Petition at 13.<sup>3/</sup> However, each of these petitioners ignore the fact that, in accordance with the Commission's recommendation, the official U.S. position for WARC-92 is that the radio astronomy service allocation in the 1610.6-1613.8 MHz band should be upgraded from secondary to primary status.<sup>4/</sup> Assuming these positions are ultimately

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<sup>2/</sup> Report, Gen. Dkt. No. 89-554, 6 FCC Rcd 3900 (1991) ("WARC-92 Report").

<sup>3/</sup> Constellation filed its Petition prior to adoption of the WARC-92 Report, but it notes that its proposed allocation is consistent with the proposed FCC recommendation for that band.

<sup>4/</sup> See WARC-92 Report at Appendix A, p. A-25 (MOD 734); United States Proposals for the 1992 World Administrative Radio Conference Dealing with Frequency Allocations in Certain Parts of the Spectrum, United States Department of State (released July 1991), at 38-39. Radio astronomers use the 1610.6-1613.8 MHz band for important spectral line observations. The 1612-MHz transition is an extremely important hydroxyl line, whose spectral emission occurs in many types of objects in the galaxy. High-angular-resolution observations of these objects using this band allows measurement of their distances and can be used collectively

adopted at WARC-92, this means that to the extent MSS operators in Region 2 use the 1610.6-1613.8 MHz portion of the 1610-1626.5 MHz band, they will be required "to take all practicable steps to protect the radio astronomy service from harmful interference. . . ." Thus, CORF does not object to an MSS uplink allocation in the 1610-1626.5 MHz band, provided that the radio astronomy allocation in the 1610.6-1613.8 MHz portion of the band is in fact upgraded and MSS proponents are able to demonstrate that they would in fact be able to provide radio astronomers the required level of protection.<sup>5/</sup>

The level of protection to radio astronomy observations that MSS operators would have "to take all practicable steps" to achieve is set forth in CCIR Report 224. Specifically, CCIR Report 224 establishes the threshold for harmful interference in the 1610.6-1613.8 MHz band at  $-237 \text{ dBW/m}^2/\text{Hz}$ . This means that the combined signal level at the radio astronomy antenna from all

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to measure the distance to the center of the galaxy.

<sup>5/</sup> On June 3, 1991, CORF filed a "Petition to Deny and Comments" on the Motorola Satellite Communications, Inc. and Ellipsat applications (File Nos. 9-DSS-P-91(87)/CSS-91-010 and 11-DSS-P-91(6)) in which it took the position that the 1610.6-1613.8 MHz band should not be expanded to include MSS uplink transmissions. However, CORF took this position prior to the Commission's adoption of its WARC-92 Report. In view of the increased level of protection which the U.S. position would afford to the radioastronomy service and the desire of the U.S. radioastronomy community to support the U.S. positions, CORF has modified its position on this issue accordingly. However, if the proposal to upgrade the radioastronomy service allocation at 1610.6-1613.8 MHz is not adopted at WARC-92 and the U.S. does not take an exception thereto, then it is CORF's position that the 1610.6-1613.8 MHz band should not be allocated for MSS uplinks.

mobile terminals of any MSS operator in the 1610.6-1613.8 MHz band cannot exceed  $-237 \text{ dBW/m}^2/\text{Hz}$ . Moreover, the filtering in such mobile terminals would have to be sufficient to comply with the  $-237 \text{ dBW/m}^2/\text{Hz}$  standard with respect to out-of-band emissions from transmissions within the spectrum immediately above the radio astronomy band as well.

Having said that, however, it bears repeating that an allocation for MSS uplinks in the 1610.6-1613.8 MHz band should be adopted only if MSS proponents can demonstrate that they can provide this level of protection. In this connection, it is important for the Commission to recognize that it will not be easy for MSS operators to meet the CCIR standard. As a general proposition, mobile (as opposed to fixed) uplinks operating in radio astronomy bands present a major problem to radio astronomers because of the difficulty of preventing them from operating in the vicinities of radio astronomy sites. When these uplink transmissions to satellites originate from aircraft (as opposed to terrestrial mobile uplinks), the problem is compounded because they cause interference to any radio astronomy observatory within a wide area around the aircraft, and terrain shielding offers no protection.<sup>5/</sup> Thus, as a general proposition, MSS uplinks are highly incompatible with co-channel radio astronomy observations.

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<sup>5/</sup> In fact, Footnote 734 states that "emissions from space or airborne stations can be particularly serious sources of interference to the radioastronomy service."



These problems were theoretically resolved with Geostar-type RDSS systems by taking advantage of the particular capabilities of that system.<sup>2/</sup> However, it has never been demonstrated that time sharing (blanking) is possible with MSS services such as

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<sup>2/</sup> In order to permit RDSS to share the same band with radioastronomy observations around 1612 MHz, the Commission requires, in Section 25.382(g) of its Rules, that "[a]ll authorizations in the radiodetermination satellite service shall be subject to" Appendix D of the Commission's Report and Order in General Docket Nos. 84-689 and 690 establishing allocation policies for RDSS. See 50 Fed. Reg. 39101, 58 RR 2d 1416 (1985). Appendix D of the Report and Order requires RDSS licensees to restrict their transmissions to occur within the first 200 milliseconds following the one-second time markers of Coordinated Universal Time when users enter Radioastronomy Regions during a period of radioastronomy observation in the 1610.6-1613.8 MHz band. Knowing in advance when such transmissions are likely to take place, radioastronomers are able to employ blanking techniques to avoid contamination of the cosmic signal by the terrestrial one. The insertion of blanking time adds overhead to the astronomical observations: when the detection of a radio signal is blanked, that portion of time is lost to the observational experiment. In practice, blanking must extend over a somewhat longer time interval than the actual transmission time to ensure that no transmission is recorded in the observational time window and that the radio receiving device recovers from possible saturation by the terrestrial transmission. In any event, implementation of such geographic and time-separation techniques is essential to this sharing arrangement.

It should be noted, however, that it has become clear, as a result of further study since the Appendix D Coordination criteria in the Report and Order were adopted, that the current definition of Radio Astronomy Regions (a circle around radioastronomy observatories with a radius of 150 kilometers for airborne transmissions and 25 kilometers for ground-based transmissions) is inadequate to protect radioastronomy from airborne transmissions and may be inadequate to protect radioastronomy from ground-based transmissions. As Section 3.3 and Table II of CCIR Report 1126 demonstrate, the minimum radius of protection necessary for airborne transmissions is about 500 kilometers, assuming an aircraft height of 10 km with 1° terrain shielding around the observatory.

voice telephony, even if digital transmissions are used. Continuous telephone conversations would seem to make it very difficult at best for an MSS operator to use time-sharing techniques, as Geostar planned to do, to protect radio astronomy operations. Thus, rather than establishing protection zones around observatories based on time-sharing, it will be necessary to establish what amount to absolute avoidance zones around observatories based on frequency-separation techniques. In other words, the MSS operator would have to avoid causing interference by not using frequencies in the 1610.6-1613.8 MHz band for mobile terminals when they were in the vicinity of radio astronomy observatories. None of the petitioners has yet demonstrated that implementation of such avoidance zones is feasible.

In view of the anticipated difficulties that MSS operators would have in providing the required level of protection to radio astronomy observatories, CORF believes that if there is to be an MSS allocation in the 1610-1626.5 MHz band, then AMSC's proposal is preferable to those of the other petitioners. AMSC proposes that the lower limit of the MSS uplink band begin at 1616.5 MHz. This 2.7 MHz of separation may be extremely helpful in adequately protecting radio astronomy observations in the 1610.6-1613.8 MHz band, assuming that the MSS operator uses sufficient filters to prevent out-of-band emissions.

II. Proposals to Allocate the 2483.5-2500 MHz Band  
for MSS Downlinks Creates a Potential Problem  
for Radio Astronomy Operations at 4990-5000 MHz

Consistent with their proposals to allocate the RDSS uplink band for MSS uplinks, Ellipsat, Constellation, and TRW also propose to allocate the corresponding RDSS downlink band, 2483.5-2500 MHz, for MSS downlinks. This proposal to use the 2483.5-2500 MHz band for MSS downlinks raises a potential problem inasmuch as the second harmonic of these downlink transmissions would fall in the 4990-5000 MHz band. The 4990-5000 MHz band is allocated on a primary basis to radio astronomy and is used extensively for continuum studies.

CCIR Report 224 establishes the threshold for harmful interference in the 4990-5000 MHz band at  $-241 \text{ dBW/m}^2/\text{Hz}$ . CORF recognizes that Footnote US74 to the Table of Allocations protects radio astronomy in this band from extraband radiation only to the extent that such radiation exceeds the level that would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates. If MSS operators were to operate in the 2483.5-2500 MHz band pursuant to the current technical rules applicable to that band, it may be possible to reduce interference in the 4990-5000 MHz band by employing adequate filtering in the satellite.

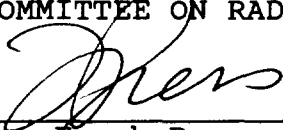
However, these petitioners do not propose to use the 2483.5-2500 MHz band for MSS downlinks in accordance with the same technical standards applicable to RDSS downlinks. Each of these

petitioners seeks to relax the power flux density limits applicable to this band. See TRW Petition at 11-13; Ellipsat Petition at 4; Constellation Petition at 12. Because of the consequent increase in interference to radio astronomy observations in the 4990-5000 MHz band and the reduced level of protection to which radio astronomy would be entitled under Footnote US74 by virtue of such a rule change, CORF opposes any relaxation of the power flux density limits applicable to this band.

Respectfully submitted,

NATIONAL ACADEMY OF SCIENCES'  
COMMITTEE ON RADIO FREQUENCIES

By:

  
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October 16, 1991

CERTIFICATE OF SERVICE

I, Robert L. Riemer, senior program officer with the National Academy of Sciences-National Research Council, do certify that on October 16, 1991, copies of the foregoing "Comments of the Committee on Radio Frequencies" were mailed first-class, U.S. postage prepaid to the following:

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